PROC. ENTOMOL. SOC. WASH.
104(3), 2002, pp. 614–623

A NEW SPECIES AND KEY FOR THE GENUS *ZONOSEMATA* BENJAMIN (DIPTERA: TEPHRITIDAE)

Allen L. Norrbom

Systematic Entomology Laboratory, PSI, Agricultural Research Service, U.S. Department of Agriculture, c/o National Museum of Natural History, Smithsonian Institution, Washington, DC 20560-0168, U.S.A. (e-mail: anorrbom@sel.barc.usda.gov)

Abstract.—New taxonomic, host, and distribution data for species of *Zonosemata* are presented. One new species, ***Z. guybushi***, reared from fruit of *Solanum lanceifolium* in Costa Rica, is described, and a revised key to the eight known species of this genus is provided. A neotype is designated for *Z. electa* (Say).

Key Words: *Zonosemata*, fruit flies, taxonomy, host plant, distribution, *Solanum*

This paper includes the first results from a project on the natural history and systematics of the fruit flies (Tephritidae) of Costa Rica. In this project, funded by the Research and Scientific Exchanges Division, Foreign Agricultural Service, USDA, I have collaborated with parataxonomists from the Instituto de Biodiversidad of Costa Rica, who are collecting and rearing fruit flies. Among the many new species and host records resulting from this project was an undescribed species of *Zonosemata* Benjamin reared by Freddy Quesada in Guanacaste. In addition to describing this species, I take this opportunity to provide a revised key to the species of *Zonosemata*, and to report additional taxonomic, host, and geographic data for other species.

Zonosemata includes eight species that are native to the New World (from southeastern Canada to Colombia and northeastern Brazil). The seven previously known species were cataloged by Norrbom et al. (1999: 249), and Smith and Bush (1999: 197) listed their known host plants. All but one of the species have been reared from fruits or at least associated as adults with species of Solanaceae, mainly in the genus *Solanum*. One species, *Z. electa* (Say), has been reared from genera other than *Solanum*, and is considered a pest of pepper and eggplant in the eastern United States and Canada.

Zonosemata belongs to the subtribe Carpomyina of the subfamily Trypetinae (Smith and Bush 1999). Jenkins (1996) questioned whether the apical desclerotized area of the female oviscape (syntergosternite 7), considered a synapomorphy for the Carpomyina by Norrbom (1989), is present in *Zonosemata*. The genitalia of the specimens from the USNM that he dissected are overcleared and this character can no longer be seen in them, but it is apparent in less cleared dissections.

Materials and Methods

Morphological terminology follows White et al. (1999). Figure 11 shows the names used for wing bands. Acronyms for institutions housing the examined specimens follow Thompson (1999).

Key to Species of *Zonosemata*

In previous keys for *Zonosemata* (Bush 1966, Hernández-Ortiz 1989), the dark

brown (often referred to as "black") markings of the thorax (see Figs. 2 and 3) were important characters in the early couplets. In the following key I have de-emphasized their importance because they appear to vary more than was previously known. For example, the katepisternal spot is consistently present in *Z. vittigera* and *Z. macgregori*, but varies in *Z. scutellata*, *Z. vidrapennis* (present in Central American specimens), and probably *Z. minuta* (present but very small in the examined specimens). It is even rarely present in *Z. electa* (in 4 specimens of the more than 100 examined from the USNM collection). The presutural scutal spot is present in *Z. vittigera*, *Z. macgregori*, and *Z. minuta* (although it is sometimes just a linear mark in the latter), but it is variable in *Z. scutellata*. The postsutural brown markings vary considerably, for example, in *Z. electa* from absent to very large (compare Figs. 2A and B).

1. Wing bands extremely narrow; width of discal, subapical and apical bands less than length of crossvein R-M (Fig. 1H). Most of radial cells and cell dm between discal and subapical bands without microtrichia. Scutum without presutural dark brown mark (Fig. 3C). Mexico, Guatemala, Honduras . . . . . *vidrapennis* Bush
– Wing bands relatively broad; width of discal and subapical bands equal to or greater than length of R-M (Figs. 1A–G, I). Radial cells and cell dm at most with small areas bare of microtrichia between these bands, or if with large bare areas (*Z. vittigera*, *Z. macgregori*), scutum with large presutural, sublateral dark brown mark (Figs. 3B, D) 2
2. Apical band extended basad along vein M, together with subapical band forming P-shaped mark (Fig. 1A). Mexico (Morelos, Guerrero, Chiapas) . . . . . *cocoyoc* Bush
– Apical band not extended along vein M 3
3. Distal 3 abdominal tergites (3–5 in male, 4–6 in female) with dark brown lateral spots, those on last 2 tergites large. Jamaica . . . *minuta* Bush
– Dark brown lateral spots present at most on distal 2 tergites, that on penultimate tergite small if present 4
4. Apical band, subapical band anterior to vein R_{4+5}, and accessory costal band faint, much paler than discal band and posterior part of subapical band (Fig. 1G). Accessory costal band often connected to subapical band. Length of first flagellomere of antenna (measured on mesal side) more than 0.7 times height of face (measured to ventral margin of antennal sockets). Colombia, Venezuela, northeastern Brazil . . . . . *scutellata* (Hendel)
– Apical and subapical bands evenly developed, similar to discal band in color (Figs. 1B–E, I). Accessory costal band variable, but not connected to subapical band. Length of first flagellomere less than 0.7 times height of face . . 5
5. Scutum without presutural dark brown marks (Fig. 2). Cells r_{4+5} and dm mostly or entirely microtrichose between discal and subapical bands. Katepisternum rarely with dark brown spot 6
– Scutum with presutural dark brown marks (Figs. 3B, D). Cells r_{4+5} and dm with large bare areas without microtrichia between discal and subapical bands. Katepisternum with dark brown spot 7
6. Discal band (measured along vein M) usually narrower than hyaline area distal to it, at most 1.1 times as broad (Figs. 1B–C). Discal, subapical and apical bands orange brown. Subscutellum and mediotergite usually orange. Southeastern Canada, eastern U.S. . . . . *electa* (Say)
– Discal band (measured along vein M) 1.21–1.34 times broader than hyaline area distal to it (Fig. 1D). Discal, subapical and apical bands brown. Subscutellum and most of mediotergite dark brown. Costa Rica . . . . . *guybushi* Norrbom, n. sp.
7. Wing bands relatively narrow, cell r_{2+3} apical to subapical band with large hyaline mark along vein R_{4+5}, at least ⅓ width of cell (Fig. 1I). Vertex usually entirely yellow except for brown ocellar tubercle. Scutum with submedial stripe usually orange anterior to transverse suture (Fig. 3D), occasionally partially to entirely red-brown or dark brown. Accessory costal band distinct. Southwestern U.S. to central Mexico . . . . . *vittigera* (Coquillett)
– Wing bands relatively broad, cell r_{2+3} apical to subapical band entirely infuscated or with narrow hyaline mark along vein R_{4+5}, at most ⅓ width of cell (Fig. 1E). Orbital plate moderate to dark brown, sometimes connected by a band across vertex. Scutum with submedial stripe usually dark brown anterior to transverse suture (Fig. 3B). Accessory costal band sometimes faint. Mexico (Baja California, Sonora) . . . . . *macgregori* Hernández-Ortiz

Zonosemata cocoyoc Bush
(Fig. 1A)

References.—Bush 1966: 319 [description]; Aluja et al. 1987: 324 [Chiapas]; Norrbom 1990: 55 [host].

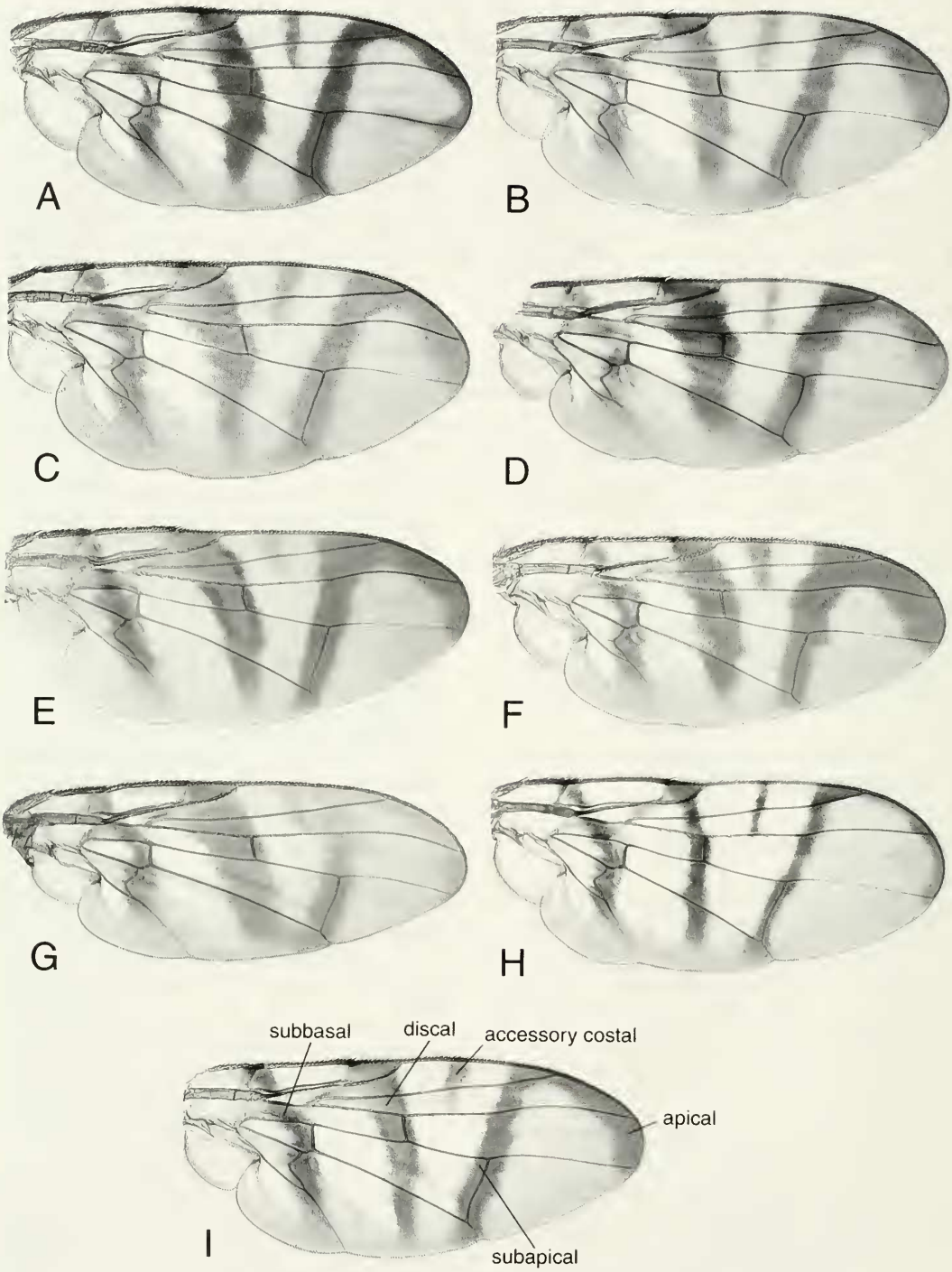

Fig. 1. Wings. A, *Zonosemata cocoyoc*. B–C, *Z. electa*. D, *Z. guybushi*. E, *Z. macgregori*. F, *Z. minuta*. G, *Z. scutellata*. H, *Z. vidrapennis*. I, *Z. vittigera*.

Recognition.—The P-shaped apical and subapical bands distinguish *Z. cocoyoc* from all other species of *Zonosemata*.

Biology.—An undetermined species of *Solanum* was listed by Norrbom (1990) as a host plant.

Distribution.—Known only from Mexico (Chiapas, Guerrero, and Morelos). The following specimen is the first reported from Guerrero.

Specimen data.—MEXICO: Guerrero: Cacahuamilpa, 2.1 mi. NW of, 23 Jul 1981, Bogar, Schaffner & Friedlander, 1♀ (TAMU, USNM52777).

Zonosemata electa (Say)
(Figs. 1B–C, 2A–B)

References.—Say 1830: 185 [description]; Bush 1966: 314 [revision]. See Foote et al. (1993: 494) for additional information and references.

Type data.—Say (1830) described this species as *Trypeta electa* based on an unstated number of specimens from Indiana. The syntypes, like the rest of Say's Diptera types, have been lost (Stone 1980: 35). To clarify the concept of this species and prevent its confusion with the similar species *Z. guybushi* (see above key for diagnostic characters, and Benjamin 1934, Bush 1966 and Foote et al. 1993 for descriptions of *Z. electa*), a male in the National Museum of Natural History (USNM) is here designated as neotype. It bears the following labels: "USA: MARYLAND: Montgomery Co., Plummer's Island, 11.VIII.1988, A. L. Norrbom, on *Solanum carolinense* L.", "USNM ENT 00052480", [red] "NEOTYPE ♂ Trypeta electa Say, 1830 desig. Norrbom 2001", and "Zonosemata electa (Say) det. Norrbom 1988".

***Zonosemata guybushi* Norrbom, new species**
(Figs. 1D, 2C)

Recognition.—This species runs to *Z. electa* in the key of Bush (1966). It differs in having broader and darker wing bands (the discal band is broader than the hyaline area between it and the subapical band measured along vein M). Cell cu_1 lacks or has only a very small nonmicrotrichose area, and the subscutellum and at least a broad medial stripe on the mediotergite are dark brown; in *Z. electa* these characters are variable, but the subscutellum and mediotergite are usually entirely orange and there is usually a large nonmicrotrichose area in cell cu_1.

Description.—*Head:* Frons with 3–4 frontal and 2 orbital setae; ocellar seta well developed. First flagellomere 0.53–0.57 mm long, 0.61–0.63 times facial height, with distinct dorsoapical point. Arista with minute pubescense (sparse in holotype). *Thorax:* Mesonotum 3.14–3.20 mm long. Dorsocentral seta aligned with postalar seta. Wing (Fig. 1D): 6.17–6.58 mm long. Pattern, as typical for genus, with following bands: subbasal, discal (covering crossvein R-M), subapical, and anterior apical bands. Bands brown, relatively broad. Discal band (measured on vein M) 1.21–1.34 times as broad as hyaline area distal to it. Discal and subapical bands broadly connected in cell cu_1 although both are fainter in that cell than more anteriorly. Wing mostly microtrichose, with parts of basal and costal cells and most of hyaline areas of cells br and dm between subbasal and discal bands bare; cell cu_1 at most with narrow bare area aligned with that in cu_1. *Abdomen:* Orange. Tergite 6 with large lateral dark brown spot. Oviscape orange, 1.66 mm long. Aculeus 1.96–2.04 mm long, tip similar to other species of *Zonosemata*, slender with minute apical notches.

Type data.—Holotype—♀ (INBio, INBIO002153791), COSTA RICA: Guanacaste: Area Conservacion Guanacaste, San Cristobal, LN 317400 383400, 620 m, emerged 8 Apr 1998 from fruits of *Solanum lanceifolium* Jacq. coll. 10 Sep 1997, 97-F. A. Quesada-134. Paratype, same data except emerged 7 May 1998, 1♀ (USNM, INBIO002153688).

Biology.—The type specimens were reared from *Solanum lanceifolium* Jacq.,

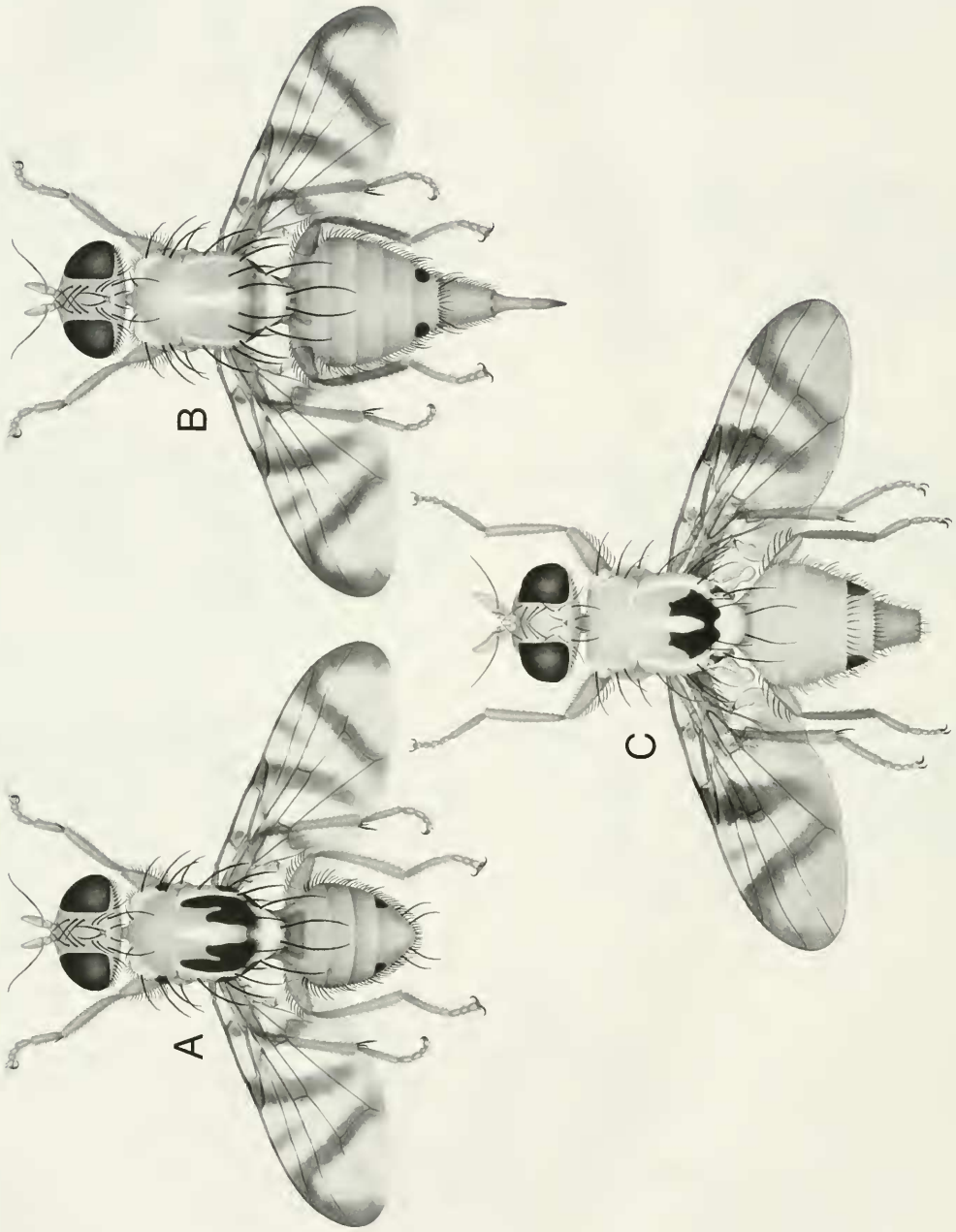

Fig. 2. Dorsal habitus. A–B. *Zonosemata electa*, male and female. C. *Z. guybushi*.

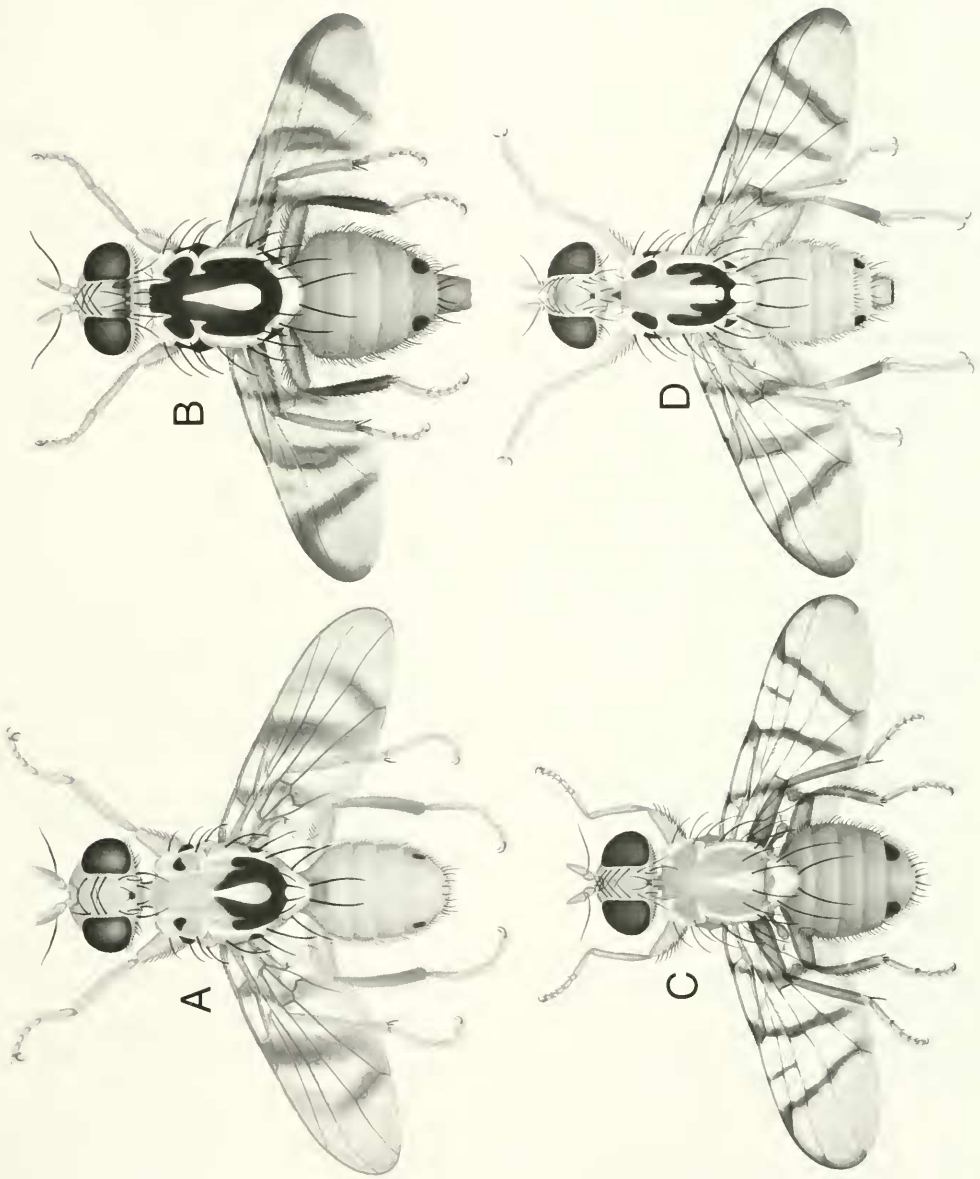

Fig. 3. Dorsal habitus. A. *Zonosemata scutellata*. B. *Z. macgregori*. C. *Z. vidvapennnis*. D. *Z. vittigera*.

which occurs in the Greater and Lesser Antilles and from Oaxaca, Mexico to Peru.

Distribution.—Known only from Costa Rica.

Etymology.—This species is named in honor of Guy L. Bush, who produced the latest comprehensive revision of *Zonosemata*.

Zonosemata macgregori Hernández-Ortiz
(Figs. 1E, 3B)

References.—Hernández-Ortiz 1989: 206 [description].

Recognition.—In general, *Z. macgregori* has the most extensive dark brown markings of any species of *Zonosemata* (Fig. 3B), although it sometimes cannot be separated from *Z. vittigera* by body color pattern alone. Both of these species have a large dark brown spot on the katepisternum and a large presutural sublateral brown mark on the scutum. In *Z. macgregori*, the submedial stripe is usually dark brown anterior to the suture, whereas it is usually orange in *Z. vittigera*, although there is overlap in this character. The width of the apical band (cell r_{2+3} apical to subapical band entirely infuscated or nearly so) distinguishes *Z. macgregori* from *Z. vittigera*. The orbital plates are moderate to dark brown, sometimes connected by a band across the vertex, whereas the top of the head is usually entirely yellow except for the ocellar tubercle in *Z. vittigera*.

Biology.—No host plant data are known.

Distribution.—Known only from Mexico (Baja California Norte, northern Baja California Sur, and Sonora). The first record from Sonora is reported below, based on a female that was compared with the type series by Vicente Hernández-Ortiz at my request.

Comments.—There is some intergradation in the scutal color pattern with *Z. vittigera*. The submedial band is partly to mostly orange anterior to the transverse suture in 2 of 5 specimens of *Z. macgregori* examined, and in some specimens of *Z. vittigera* from Mexico it is partially or entirely red brown or dark brown. Whether the submedial stripe and presutural lateral spot are connected (considered a diagnostic character for *Z. macgregori* by Hernández-Ortiz) varies in both species, although the connection is orange if present in *Z. vittigera*, whereas it may be brown in *Z. macgregori*. The difference in the width of the wing bands, especially the apical band, seems consistent, although this is based on a rather small sample of *Z. macgregori*. Study of larger samples of specimens or analysis using other methods would be useful to confirm that these populations are not conspecific with those of *Z. vittigera*. Discovery of their host plant would also be helpful in this regard. *Solanum elaeagnifolium* Cav., the only known host plant of *Z. vittigera*, occurs in Sonora and at least the extreme north of Baja California Norte (Wiggins 1980), but I do not know if it occurs in the other areas from which *Z. macgregori* is known.

Specimen data.—MEXICO: Baja California Sur: near Candelaria, 17 Mar 1992, R. Garces & R. Wharton, 1♂ (USNM52781); San Jose Viejo, 20 Mar 1992, R. Wharton & R. Garces, 1♀ (TAMU USNM52783); same, 18 Oct 1991, 1♀ (TAMU USNM52782); Santiago, 16 Mar 1992, R. Garces & R. Wharton, 1♀ (USNM52780). Sonora: San Jose Guaymas, 3 Apr 1989, FRB-13-89, 1♀ (USNM53368).

Zonosemata scutellata (Hendel)
(Figs. 1G, 3A)

References.—Hendel 1936: 73 [description, Brazil], Steyskal 1974: 234 [description as *Z. ica*, Colombia]; Norrbom 1990: 53 [synonymy, Venezuela, hosts].

Comments.—This species is known from Colombia, Venezuela, and northeastern Brazil. Its biology is poorly known. Norrbom (1990) listed data for several specimens from Venezuela that were at least associated with a species of *Solanum*; whether or not they were reared is uncertain. The following specimens were clearly reared from a *Solanum* species and provide anoth-

er data point for the distribution of *Z. scutellata.*

Specimen data.—VENEZUELA: Zulia: Mision del Tokuko (9°42′51″N 72°46′33″W), 300 m., [reared] ex fruto de cojon de gato (*Solanum* sp.), 15 Aug 1995, K. Katiyar & J. Oroño, 2♂1♀ (USNM48730–32).

Zonosemata vidrapennis Bush
(Figs. 1H, 3C)

References.—Bush 1966: 321 [description]; Norrbom 1990: 55 [host].

Recognition.—The extremely narrow wing bands distinguish *Z. vidrapennis* from all other species of *Zonosemata* (Fig. 1H). Only it, *Z. vittigera,* and *Z. macgregori* have large nonmicrotrichose areas in the radial cells and cell dm between the discal and subapical bands. Both of the latter species have a dark brown, presutural, sublateral mark on the scutum that is absent in *Z. vidrapennis* (Fig. 3C).

Distribution.—Mexico (Michoacán, Mexico, Puebla, Veracruz, Oaxaca, Chiapas), Guatemala, Honduras.

Biology.—The Honduran specimens were collected on fruits of *Solanum lanceolatum* Cav., which is native from southern Mexico to western Panama and is an introduced weed in California. As this is a likely host plant, *Z. vidrapennis* may be a potential biological control agent for this invasive plant. An undetermined species of *Solanum* was listed by Norrbom (1990) as a host plant in Mexico.

Comments.—The specimens from Guatemala and Honduras differ from Mexican specimens in having a large, U-shaped dark brown mark on the scutum and scutellum, a small dark brown area on the notopleuron, a small brown area on the katepisternum, and a mostly to entirely dark brown subscutellum and mediotergite. These areas are entirely orange in the Mexican specimens, although all of the specimens have large spots on the last abdominal tergite, on the anepimeron, and in males, on the epandrium, so this does not appear to be age-related variation. More detailed study of additional specimens, particularly reared series from both Mexico and Central America, is needed to confirm if this is geographic variation as it is here interpreted.

Specimen data.—GUATEMALA: Escuintla: Escuintla, Grutas de San Pedro Martir, 10 Jul 1965, P.J. Spangler, 1♂ (USNM52409). HONDURAS: Intibucá: Yamaranguila, Las Hortencias, 14°21′11.9″N 88°14′57.5″W, 2150 m, on fruits of *Solanum lanceolatum* Cav., 8 Jun 1998, L. Cañas, 2♂ (USNM52410–1). MEXICO: Chiapas: San Cristobal de las Casas, 35 mi. E, 26 Jul 1957, J.A. Chemsak & B.J. Rennells, 1♀ (UCB). Michoacán: Tzintzuntzan, 7000 ft., 8 Aug 1954, R.E. Ryckman, D. Spencer & C.P. Christianson, 1♀ (USNM52408). Oaxaca: El Punto, 10.8 mi S of, 6100 ft., 19 Jul 1987, R. Wharton, 1♀ (TAMU USNM52779); La Cumbre, 3.2 mi. SW of, 18 Jul 1985, Jones & Schaffner, 1♂ (TAMU USNM52778); Mitla, 5500 ft., 25 Jul 1962, H.E. Milliron, 4♂ (CNC USNM52398–401) 1♂1♀ (USNM52403–4); same except 27 Jul 1962, 1♀ (CNC USNM52402); Oaxaca, Monte Alban, 22 Jul 1963, A. Gillogly, 1♀ (UCR). Puebla: Calcaloapan, 19 mi. NW, 30 Jul 1963, J. Doyen, 1♀ (UCB USNM52407).

Zonosemata vittigera (Coquillett)
(Figs. 1I, 3D)

References.—Coquillett 1899: 261 [description]; Cazier 1962: 181 [biology]; Bush 1966: 315 [revision]; Goeden and Ricker 1971: 417 [biology]. See Foote et al. (1993: 496) for additional references.

Recognition.—This species differs from other species of *Zonosemata,* except *Z. vidrapennis* and *Z. macgregori,* by having most of cells r_{4+5} and dm without microtrichia between the discal and subapical bands. It differs from *Z. vidrapennis* in having broader wing bands (particularly the apical band) (Fig. 1I) and a presutural sublateral dark brown spot on the scutum (Fig. 3D) and a dark brown spot on the katepisternum. It differs from *Z. macgregori* in having a narrower apical band (cell r_{2+3}

with a large hyaline spot between the apical band and vein R_{4+5}). The submedial band on the scutum is usually orange anterior to the transverse suture, whereas in *Z. macgregori* it is usually dark brown, but there is overlap in this character in these two species.

Biology.—*Solanum elaeagnifolium* Cav. is the only known host (Cazier 1962, Goeden and Ricker 1971).

Distribution.—Mexico (Chihuahua, Coahuila, Durango, Guanajuato, Michoacán, San Luis Potosí, Sonora, Tamaulipas, Zacatecas; Distrito Federal?) and southwestern United States (southeastern California to Oklahoma and Texas). In Mexico, *Z. vittigera* occurs at least as far south as Guanajuato (Bush 1966). The record from Distrito Federal (Foote 1967) may be an error based on the statement by Bush (1966: 318) that *Z. vittigera* "ranges from just north of Mexico, D.F." The Specimen Data section includes previously unreported records from Mexico.

Comments.—Of 53 specimens from Mexico that I examined, 16 (2 of 5 from Chihuahua, 2 of 7 from Coahuila, and 3 of 8 from Durango, 11 of 31 from Zacatecas) have the submedial stripes at least partially red-brown to dark brown anterior to the transverse suture. One Durango female in the CNC (USNM52414) is unusual in having a pair of submedial and a pair of sublateral dark brown spots on tergite 5 in addition to the normal pair on tergite 6. A female from Coahuila (USNM52435) has the discal and subapical bands broadly connected in cell cu_1.

Specimen data.—MEXICO: Chihuahua: Chihuahua, 17 mi. W, 11 Jul 1964, J. Powell or J.A. Chemsak, 2♀ (UCB USNM53369–70); Ciudad Jiménez, 16 km N, 26 Aug 1991, T. Griswold, 1♀ (USU USNM52434); Mapini dunes, N of, 22 Aug 1991, T. Griswold, 1♀ (USU); Samalayuca, 6 Aug 1950, R.F. Smith, 1♀ (AMNH USNM52433). Coahuila: 20 km. from Saltillo, 26 Jun 1986, Wapshere & Segura, 2♂,1♀ (USNM52435, 53371–2); Nueva Rosita, 29 Aug 1974, G. Bohart & W. Hanson, 1♂ (USNM52436); Saltillo, 12.4 mi. S of, 4 Jul 1985, J. Wooley & G. Zolnerowich, 3♂ (TAMU). Durango: Durango, 5 mi. W, 6500 ft., 14 Jul 1964, J.F. McAlpine, 1♂,1♀ (CNC USNM52412–13); Durango, Hwy. 45, 25 mi. S, 24 Jul 1964, L.A. Kelton, 1♀ (CNC USNM52414); La Zarca, 2 mi. S, 16 Jul 1964, J.A. Chemsak, 1♂ (UCB USNM52438); Pedricena, 5 mi. S of, 29 Jul 1966, P. M. & P. K. Wagner, 1♂ (TAMU USNM52798); Tlahualilo, 4 Sep 1904, A.W. Morrill, 1♀ (USNM52437); Yerbanis, 1 mi. SW of, 12 Aug 1965, H. Burke & J. Meyer, 2♂ (TAMU USNM52796–7). Michoacán: Italia, 28 Apr 1965, A.H. Lewis, 1♀ (USNM52439). San Luis Potosí: San Lorenzo, 1 mi. S of, 25 Jul 1976, Peigler, Gruetzmacher, R. & M. Murray, Schaffner, 1♀ (USNM52784). Tamaulipas: Matamoros, 2 Jul 1955, T. R. Stephens, 1♀ (USNM52443); Reynosa, 10 Jul 1935, F.O. Swan, 1♂ (USNM52444). Zacatecas: Concepcion del Oro, 13 mi. SW of, 9 Jul 1983, Kovarik, Harrison, Schaffner, 1♂,1♀ (TAMU); Concepcion del Oro, 30 mi. SW of, 9 Jul 1983, Kovarik, Harrison, Schaffner, 4♀ (TAMU); Concepcion del Oro, 4 mi. NE of, 4 Jul 1984, Schaffner, Woolley, Carroll, Friedlander, 11♂,2♀ (TAMU) 4♂,1♀ (USNM52790–4); same, J.B. Woolley, 3♂,5♀ (TAMU); Concepcion del Oro, 6 mi. S of, 4 Jul 1984, Carroll, Schaffner, Friedlander, Woolley, 1♂ (USNM52795); Luis Moya, 14 mi. N of, 26 Jul 1959, R.B. Selander & J.C. Schaffner, 1♀ (USNM52442).

Acknowledgments

I thank Freddy Quesada (formerly INBio) and Manuel Zumbado (INBio), who through diligent effort discovered the new species from Costa Rica; Luis Cañas (Purdue Univ.), for permission to include his data for *Z. vidrapennis* from Honduras; and Kamta Katiyar (Univ. del Zulia) for the specimens of *Z. scutellata*. I am also grateful to the curators of the other institutions who loaned study material. Vicente Hernán-

dez-Ortiz kindly compared several specimens with the type series of *Z. macgregori*, and M. A. Condon, A. Freidberg, M. Pogue, G. J. Steck and N. E. Woodley reviewed the manuscript. Lucrecia Rodriguez produced the wing images, and Taina Litwak the habitus images. This work was partially supported by USDA, FAS, RSED (Project No. CS-ARS-6, Grant No. FG-CR-107).

Literature Cited

Aluja S., M., M. Cabrera, E. Rios, J. C. Guillen A., H. Celedonio H., J. P. Hendrichs, and P. Liedo F. 1987. A survey of the economically important fruit flies (Diptera: Tephritidae) present in Chiapas and a few other fruit growing regions in Mexico. Florida Entomologist 70: 321–329.

Benjamin, F. H. 1934. Descriptions of some native trypetid flies with notes on their habits. United States Department of Agriculture Technical Bulletin 401, 95 pp.

Bush, G. L. 1966. The genus *Zonosemata*, with notes on the cytology of two species. Psyche (Cambridge) (1965) 72: 307–323.

Cazier, M. A. 1962. Notes on the bionomics of *Zonosemata vittigera* (Coquillett), a fruit fly on *Solanum* (Diptera: Tephritidae). Pan-Pacific Entomologist 38: 181–186.

Coquillett, D. W. 1899. Notes and descriptions of Trypetidae. Journal of the New York Entomological Society 7: 259–268.

Foote, R. H. 1967. Family Tephritidae (Trypetidae, Trupaneidae), 91 pp. *In* Papavero, N., ed. A Catalogue of the Diptera of the Americas South of the United States. 57. Departamento de Zoologia, Secretaria da Agricultura, São Paulo.

Foote, R. H., F. L. Blanc, and A. L. Norrbom. 1993. Handbook of the Fruit Flies (Diptera: Tephritidae) of America North of Mexico. Comstock Publishing Associates, Ithaca, xii + 571 pp.

Goeden, R. D. and D. W. Ricker. 1971. Biology of *Zonosemata vittigera* relative to silver-leaf nightshade. Journal of Economic Entomology 64: 417–421.

Hendel, F. G. 1936. Ergebnisse einer zoologischen Sammelreise nach Brasilien, insbesondere in das Amazonasgebiet, ausgeführt von Dr. H. Zerny. X Teil. Diptera: Muscidae Acalyptratae (excl. Chloropidae). Annalen des Naturhistorischen Museums in Wien 47: 61–106.

Hernández-Ortiz, V. 1989. Una especie nueva de *Zonosemata* (Diptera: Tephritidae) y clave de identificación de las especies del género. Anales del Instituto de Biologia, Universidad Nacional Autonoma de Mexico, Serie Zoologia 60: 205–210.

Jenkins, J. 1996. Systematic studies of *Rhagoletis* and related genera (Diptera: Tephritidae). Dissertation, Michigan State University, East Lansing, 184 pp.

Norrbom, A. L. 1989. The status of *Urophora acuticornis* and *U. sabroskyi* (Diptera: Tephritidae). Entomological News 100: 59–66.

———. 1990. Notes on *Zonosemata* Benjamin (Diptera: Tephritidae) and the status of *Cryptodacus scutellatus* Hendel (= *Z. ica* Steyskal syn. n.). Annalen des Naturhistorischen Museums in Wien 91: 53–55.

Norrbom, A. L., L. E. Carroll, F. C. Thompson, I. M. White, and A. Freidberg. 1999. Systematic database of names, pp. 65–251. *In* Thompson, F. C., ed. Fruit Fly Expert Identification System and Systematic Information Database. Myia (1998) 9, vii + 524 pp. & Diptera Data Dissemination Disk (CD-ROM) (1998) 1.

Say, T. 1830. Descriptions of North American dipterous insects [concl.]. Journal of the Academy of Natural Sciences of Philadelphia (1829) 6: 183–188.

Smith, J. J. and G. L. Bush. 1999. Phylogeny of the subtribe Carpomyina (Trypetinae), emphasizing relationships of the genus *Rhagoletis*, pp. 187–217. *In* Aluja, M. and A. L. Norrbom, eds. Fruit flies (Tephritidae): Phylogeny and Evolution of Behavior. CRC Press, Boca Raton, [16] + 944 pp.

Steyskal, G. C. 1974. A new species of *Zonosemata* Benjamin from Colombia (Diptera: Tephritidae). Journal of the Washington Academy of Science 64: 234–235.

Stone, A. 1980. History of Nearctic Dipterology. Flies of the Nearctic Region 1(1): 1–62.

Thompson, F. C. 1999. Data dictionary and standards, pp. 49–63. *In* Thompson, F. C., ed. Fruit Fly Expert Identification System and Systematic Information Database. Myia (1998) 9, vii + 524 pp. & Diptera Data Dissemination Disk (CD-ROM) (1998) 1.

White, I. M., D. H. Headrick, A. L. Norrbom, and L. E. Carroll. 1999. Glossary, pp. 881–924. *In* Aluja, M. and A. L. Norrbom, eds. Fruit flies (Tephritidae): Phylogeny and Evolution of Behavior. CRC Press, Boca Raton, [16] + 944 pp.

Wiggins, I. L. 1980. Flora of Baja California. Stanford University Press, Stanford, 1025 pp.